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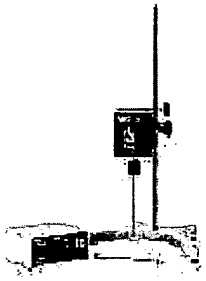
Solubility

Definition

The **solubility** of a substance is the maximum amount of a material (called the **solute**) that can be dissolved in given quantity of solvent at a given temperature. When a solute is dissolved in a solvent to give a homogeneous mixture, one has a solution.

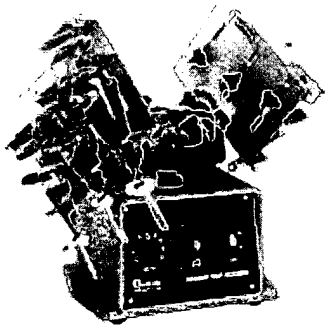
Solubility is generally expressed as the number of grams of solute in one liter of saturated solution. For example, 12 g/L at 25 ^{o}C.

Molar solubility is the number of moles of solute in one liter of saturated solution. For example, 0.115 mol/L at 25 ^{o}C.



Keep your solutions well-stirred with stirrers from Safety Emporium.

Additional Info



Mix things up around the lab with automatic shakers from Safety Emporium.

For about 95% of all compounds, solubility in water increases with increasing temperature. Many compounds can have their solubility in water increased or decreased by the presence of another solute.

Solubilities can be broken into four general classes:

1. Soluble -
2. Slightly soluble
3. Sparingly soluble
4. Insoluble

Sparingly soluble materials have very low solubilities such as 0.5 g per liter or (much) lower.

When discussing the solubility of one liquid in another, two additional terms are sometimes used:

1. **Immiscible** liquids are insoluble in each other. Oil and water is a typical example.
2. **Miscible** liquids form one homogeneous liquid phase regardless of the amount of either component present. A good example is methanol in water.

The chemical basis for why some materials are soluble in each other while others are insoluble is beyond the scope of this text. See Further Reading below for some good General Chemistry explanations.

Books Available

- "Solubility and Solubilization in Aqueous Media", Hardcover, 496 pages, 1999. Estimated price $125.00. Info and/or order.
- "Solubility and Related Properties", Hardcover, 1986. Estimated price $185.00. Info and/or order .

MSDS Relevance

Knowing the solubility of a material can help you know if it may contaminate waste water, what the concentration of a solution may be, how much material will dissolve in a given volume of water, and much more. Solubilities are very handy and versatile.

Bzzzt: Some folks have reported seeing terms like "WATER -Z26020" or "WATER -Z1076" on Sigma Chemical MSDS's. These are the result of a computer coding error. Contact the manufacturer directly to get a revised/updated sheet or report the problem.

Further Reading

- Walt Volland discusses solubility and solutions over several pages.
- Solubility info at SparkNotes (beware: pop-under ads and cookies...)
- R.H. Logan discusses solvents and solubility.
- Solutions, Solvents and Solutes at the U of Rochester, colorful graphics.
- Solutions and Their Properties at the U of Florida (superb graphics).

See also: Concentration units, mole, solvent.
